The Multiclass Fault Diagnosis of Wind Turbine Bearing Based on Multisource Signal Fusion and Deep Learning Generative Model

Year: 2022 | Citations: 167 | Authors: Liang Zhang, Hao Zhang, G. Cai

Abstract

Low fault diagnosis accuracy in case of insufficient and imbalanced samples is a major problem in the wind turbine fault diagnosis. The imbalance of samples refers to the large difference in the number of samples of different categories or the lack of a certain fault sample, which requires good learning of the characteristics of a small number of samples. Sample generation in the deep learning generation model can effectively solve this problem. In this study, we proposed a novel multiclass wind turbine bearing fault diagnosis strategy based on the conditional variational generative adversarial network (CVAE-GAN) model combining multisource signals fusion. This strategy converts multisource 1-D vibration signals into 2-D signals, and the multisource 2-D signals were fused by using wavelet transform. The CVAE-GAN model was developed by merging the variational autoencoder (VAE) with the generative adversarial network (GAN). The VAE encoder was introduced as the front end of the GAN generator. The sample label was introduced as the model input to improve the model's training efficiency. Finally, the sample set was used to train encoder, generator, and discriminator in the CVAE-GAN model to supplement the number of the fault samples. In the classifier, the sample set is used to do experimental analysis under various sample circumstances. The results show that the proposed strategy can increase wind turbine bearing fault diagnostic accuracy in complex scenarios.